CLAIMS

What is claimed is:

1. A method of performing spectrophotometric analysis on a portion of a liquid sample in a clinical analyzer, comprising the steps of:

providing one or more sample containers holding an amount of sample liquid, and providing a clinical analyzer with a sample handler, a metering system, a supply of reagents; and

simultaneously performing repeating cycles of a first clinical chemistry process conducting clinical tests, and a parallel spectrophotometry process conducting spectrophotometric analysis;

wherein at least a portion of sample liquid is passed from the first clinical chemistry process to the spectrophotometry process.

2. A method of performing measurements on at least a portion of a liquid sample in a clinical analyzer, comprising the steps of:

(a) providing a clinical analyzer with sample handling apparatus having one or more sample containers holding an amount of sample liquid; with sample metering apparatus having a proboscis, one or more metering tips having a tubular shape with a metering aperture at one end, a metering pump coupled with the proboscis; and sample processing apparatus having one or more test elements;

(b) attaching a tip to the proboscis to create a metering assembly;

(c) moving the metering assembly to an initial aspiration position, in which the metering aperture of the tip is immersed in sample liquid;

(d) creating a partial vacuum with the metering pump, causing a selected volume of sample liquid to be aspirated from a sample container into the tip;

(e) moving the metering assembly to a dispensing position;

(f) creating a partial pressure with the metering pump, causing a portion of the sample liquid to be dispensed from the metering tip onto a test element;

(g) the sample processing apparatus then performing at least one clinical chemistry test and analysis;

(h) the metering assembly moving to a tip ejection position;

(i) removing the metering tip from the proboscis;

(j) performing a sample quality measurement on the sample liquid in the ejected tip;

wherein said steps (b)-(h) are repeated in a primary analyzer cycle; wherein said steps (h)-(j) are repeated in a secondary sample quality cycle; such that at least portions of the primary and secondary cycles occur simultaneously.

3. The method of Claim 2, wherein the test elements are thin film slides.

4. The method of Claim 2, wherein the step of performing a sample quality measurement includes performing at least one additional test that is also conducted during said step of performing clinical chemistry tests, further comprising the additional step of:

comparing the results of the tests, and using the comparison to calibrate the analyzer.

5. The method of Claim 2, wherein the sample quality measurement is performed by a spectrophotometer.

6. A method of performing measurements on at least a portion of a liquid sample in a clinical analyzer, comprising the steps of:

(a) providing a clinical analyzer with sample handling apparatus having one or more sample containers holding an amount of sample liquid; with sample metering apparatus having a proboscis, one or more metering tips having a tubular shape with a metering aperture at one end, a metering pump coupled with the proboscis; and sample processing apparatus having one or more test elements;

(b) attaching a tip to the proboscis to create a metering assembly;

(c) moving the metering assembly to an initial aspiration position, in which the metering aperture of the tip is immersed in sample liquid;

(d) creating a partial vacuum with the metering pump, causing a selected volume of sample liquid to be aspirated from a sample container into the tip;

(e) moving the metering assembly to a dispensing position;

(f) creating a partial pressure with the metering pump, causing a portion of the sample liquid to be dispensed from the metering tip onto a test element;

(g) the sample processing apparatus then performing at least one clinical chemistry test and analysis;

(h) the metering assembly moving to a tip ejection position;

(i) removing the metering tip from the proboscis;

(j) performing a spectrophotometric measurement on the sample liquid in the ejected tip;

wherein said steps (b)-(h) are repeated in a primary analyzer cycle; wherein said steps (h)-(j) are repeated in a secondary spectrophotometric cycle; such that at least portions of the primary and secondary cycles occur simultaneously.

7. The method of Claim 6, whereby the throughput of the analyzer is increased to a rate greater than a serial method of operating an analyzer.

8. The method of Claim 6, wherein the tips have a tubular body and a capillary tip, connected by a cone such that the sample quality measurement is performed though the cone of the tip.

9. The method of Claim 6, wherein at least some of said steps are conducted automatically by a computer.

10. The method of Claim 6, wherein the sample quality measurement step includes measuring hemoglobin, lipids, bilirubin, and biliverdin.

11. A method of analyzing a portion of a liquid sample in a clinical analyzer, comprising the steps of:

providing one or more sample containers holding an amount of sample liquid, and providing a clinical analyzer with a sample handler, a metering system, a supply of reagents; and

simultaneously performing repeating cycles of a first clinical chemistry process conducting clinical tests, a parallel spectrophotometry process conducting spectrophotometric analysis, and a parallel second clinical chemistry process conducting clinical tests;

wherein at least a portion of sample liquid is passed from the first clinical chemistry process to the spectrophotometry process, and at least a portion of sample liquid is passed from the spectrophotometry process to the second clinical chemistry process.

12. A method of performing measurements on at least a portion of a liquid sample in a clinical analyzer, comprising the steps of:

(a) providing a clinical analyzer with sample handling apparatus having one or more sample containers holding an amount of sample liquid; with sample metering apparatus having a proboscis, one or more metering tips having a tubular shape with a metering aperture at one end, a metering pump coupled with the proboscis; and sample processing apparatus having one or more test elements;

(b) attaching a tip to the proboscis to create a metering assembly;

(c) moving the metering assembly to an initial aspiration position, in which the metering aperture of the tip is immersed in sample liquid;

(d) creating a partial vacuum with the metering pump, causing a selected volume of sample liquid to be aspirated from a sample container into the tip;

(e) moving the metering assembly to a dispensing position;

(f) creating a partial pressure with the metering pump, causing a portion of the sample liquid to be dispensed from the metering tip onto a test element;

(g) the sample processing apparatus then performing at least one clinical chemistry test and analysis;

(h) the metering assembly moving to a tip ejection position;

(i) removing the metering tip from the proboscis;

(j) performing a sample quality measurement on the sample liquid in the ejected tip;

(k) aspirating a selected auxiliary volume of sample liquid from the tip;

wherein said steps (b)-(h) are repeated in a primary analyzer cycle; wherein said steps (h)-(j) are repeated in a secondary sample quality cycle; such that at least portions of the primary and secondary cycles occur simultaneously.

13. The method of Claim 12, further comprising the step of:

(l) passing the auxiliary volume of sample liquid to a wet chemistry analyzer system.

14. The method of Claim 12, further comprising the steps of:

(l) passing the auxiliary volume of sample liquid to a diluter system;

(m) diluting the auxiliary volume of sample liquid to form a diluted liquid;

(n) passing the diluted liquid to the sample processing apparatus; and

(o) the sample processing apparatus then performing at least one clinical chemistry test and analysis on the diluted liquid.

15. A clinical analyzer for analyzing at least a portion of a liquid sample, comprising:

sample handling apparatus having one or more sample containers holding an amount of sample liquid;

sample metering apparatus having a proboscis defining a metering lumen, one or more tips with a tubular shape and a metering aperture at one end, and a metering pump coupled with the proboscis lumen; the tips being removably attachable to the proboscis and allowing fluid communication between the metering pump and the metering aperture through the proboscis lumen;

sample processing apparatus having one or more test elements, an incubator and at least a thin film clinical chemistry system and a wet chemistry clinical testing system for conducting clinical tests on the liquid samples; and

sample quality apparatus having a spectrophotometer and a tip end clamping device;

the analyzer having several operating stations:

(a) an initial aspiration position where a metering aperture of the tip can be periodically immersed in sample liquid held within one of the sample containers; the metering pump adapted to create a partial vacuum to cause a selected volume of sample liquid to be aspirated from a sample container into the tip;

(b) a dispensing position where the metering pump can create a partial pressure to cause a portion of the sample liquid to be dispensed from the tip onto a test element;

(c) a thin film clinical chemistry testing position;

(d) a sample quality measurement position;

(e) a wet chemistry testing position.